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§ 220. **Plants of Western Iowa.**—We owe an apology to the Rev. Robert Burgess, of Ames, Iowa, for delay in publishing a note on deficiencies in Arthur's Catalogue of Iowa plants. The note is now rather out of date, but we subjoin a list of the plants sent us, as well as we could make out from the specimens, which were not always perfect enough for a satisfactory determination. We have appended a query mark to those about which we were doubtful: 1. Cynthia Virginiana, Don.—2. Coreopsis lanceolata, L. ?—3. Parnassia Caroliniana, Mchx. — 4. Linaria Canadensis, Spreng. — 5. Arenaria Michauxii, Gray.—6. Viola pedata, L.—7. Salix tristis, Ait.—8. Cyperus inflexus, Muhl.—9. Alopecurus geniculatus, L.—10. Synthyris Houghtoniana, Benth.—11. Cypripedium parviflorum, Salisb. ?—12. Ammania latifolia, L.—13. Polygonum incarnatum, Ell. —14 Aster Tradescanti, L., *var.* fragilis. ? ?—15. Osmunda Claytoniana, L.—16. Festuca nutans, Willd.—16 *bis.* Festuca elatior, L.—17. Senecio canus, Hook. ?—18. Lespedeza hirta, Ell., *var.* sparsiflora, T. & G.—19. Valeriana edulis, Nutt.—20. Arabis lævigata, DC.—21. Arabis hirsuta, Scop.—22. Trifolium reflexum, L.—23. Cerastium viscosum, L.—24. Lechea, a strict form which seems peculiar to the region about the Upper Mississippi.—25. Salix discolor, Muhl. —26. Potamogeton fluitans, Roth. ?—27. Hypericum Canadense, L., *var.* major.—28. Menyanthes trifoliata, L.—29. Hemicarpha subsquarrosa, Nees. — 30. Physalis Philadelphica, Lam. ? — 31. Physalis pubescens, L.—32. Plantago major, L.—33. Euphorbia glyptosperma, Eng.—34. Euphorbia serpyllifolia, Pers. ?—35. Cyclachaena xanthiifolia, Fres.—36. Artemisia Canadensis, Mchx.—37. Poa annua, L.—38. Cyperus diandrus, Torr., *var.* castaneus.—39. Sporobolus cryptandrus, Gray.

§ 221. **Growth of Exogens.**—The accepted theory of growth in the stems of Exogens, especially in the regions of frost, is that during the period of foliation great activity goes on in the movement of the fluids throughout the plants structure, and that during that season of activity a new *tube* of wood is formed around the stem; that this new formation is marked by vascular tissue on the inner surface, and by a more dense and compact tissue on the outer surface.

On cross sections of most Exogenous stems, this tube is distinctly marked by the different tissues which make up the new formation. This new tube of wood is believed to be the result of one season's growth. In the regions of frost this season is the period of foliation.

Hence each marking is made by a period of great activity and a period of repose, constituting in the regions of frost an entire year.

Why this tube should have on its inner surface a lining of porous structure, while the outer layer is composed of tissues whose structure is more dense, has not been explained. It has been suggested that, during the months of February and March the outer layer of bark is reptured in the direction of the axis of growth, and hence offers little resistance to the expansion of the cambium which results from the large deposits of cell material. Under this slight pressure the vascular tissues form, while, later in the season, the space between the bark and wood becomes more and more crowded, the cell material is all the while subjected to increasing pressure, and the tissues formed later spread out in the direction of the circumference of the stem, are hence greatly flattened, and the bore so reduced as to present a more dense appearance.

That there are some plants among Exogens that do not present a distinct marking, and some that have none whatever, does not disturb this general theory of growth. Such cases may be set down fairly and properly as unexplained exceptions. On the other hand that there are Exogens that do constantly form two or more tubes of wood in a year does not refute the theory. I have laid upon the table here, this evening, specimens of Exogenous stems which have made from five to ten distinct separable rings in one season. The Beet has been brought up here as an instance of the formation of more than one ring in a year. But the whole order Chenopodiaceæ, with Amarantaceæ and other allied orders are subject to these phenomena, and I think these exceptions are far more numerous than is generally supposed.

What we wish to get at, however, is this: Is it true in general, that our Exogens may, and frequently do, form more than one distinct tube of wood in one year?

If the formation depends upon two conditions, viz : a period of activity and one of repose, then it would be logical to infer that a ring of wood may be formed, whenever, and as often as, these two opposite conditions succeed each other, and that the rings, or tubes, would be more or less sharply distinguishable, as those periods were sharp in succession For example: if, after the the middle of July, a severe drought should come on, accompanied by much high wind, and should prevail till the end of August, and this drought be succeeded by a very warm and wet September, I believe that two distinct tubes of wood would be made by most of our Exogens, and that these rings would be so sharply distinguishable as to seem like two years' growth

There are other circumstances generally present that may make two or more markings in one year, not so sharply distinguishable.

My attention was first drawn to this subject by the examination of a potatoe, which had made what the farmers call a second growth. It was after a severe drought had been succeeded by a wet season, and potatoes took on a new layer which more than quadrupled the size they had attained previous to the wet period.

I have examined many stems, and find that the Beet, Chenopodium, Amarantus, Atriplex, and other genera of these and allied orders are constant exceptions to the accepted theory.

From my observations I infer that the Magnolia glauca makes two or more rings of wood in a year. I have noticed that the Magnolia puts forth three distinct sets of leaves in one year. The first crop appears in May; in the course of about three weeks another very distinct crop appears; the third appearing late in June. In the intervals there must be a considerable amount of cell material diverted from wood structure to leaf building, and the growth of the stem must be arrested. When the new crop of leaves are mature, they will begin again to throw down large quantities of cell material, and the lining of a new tube will be commenced. During these alternations, different sorts of tissues are necessarily formed, and the markings on a cross section have the appearance of indistinct rings.

The Robinia is another notable example of this. I have laid upon the table a specimen of an eight year old stem, upon which may be counted nine distinct rings and many indistinct ones. It was cut in June, and two distinct rings had already been formed, one made up of the cells that were forming the inner lining of the new tube of wood, and the other made up of the bast cells, forming the new layer of bark. It will be found on a close examination of the section, that the greater vessels are arranged in concentric layers of bundles not in contact, making imperfect or intermediate rings. These bundles are so mingled with the woody tissues as so give the layers in some degree a homogeneous appearance, entirely wanting in most stems.

As has been stated, the accepted theory of Exogenous growth is, that a new tube of wood is annually formed outside the last year's growth. This theory is based upon well authenticated observation, and no theory in Natural History is admissible, unless it is born out of observation and experiment. I do not presume to offer a new one, yet I believe that the old theory will yet undergo great modification, as more light is thrown upon this interesting question. I do not hesitate to say that from my observations I am forced to the conclusion that, as Exogens require a period of activity and a season of rest to form a tube of wood, they may and do form new tubes whenever these conditions sharply succeed each other.

O. R. WILLIS.

§ 222. **Botanical Directory for 1878.**—Parts I. and II., containing the names and specialties of Botanists, are now ready for distribution. Part III., relating to Libraries, Herbaria, etc., will probably be ready in May, when it will be forwarded to subscribers.

§ 223. **When the Leaves fall.**—Mr. N. L. BRITTON, of New Dorp, Staten Island, has kindly sent us the following excellent contribution to this subject. Mr. Britton observes that "the female in dioecious plants appears to hold its foliage longer than the male." He has "noticed this very strongly marked in Ailanthus glandulous, Acer saccharinum and A. rubrum, and Salix alba and S. discolor, but not in Populus. Ilex opaca and Kalmia latifolia hold green leaves all winter."

For want of space we have left out two columns of Mr. Britton's tables; the first, for September 29th, when the leaves were all on the plants mentioned except those marked with *, and the last, for November 30th, when all the leaves were off except those marked †. Of the former Cephalanthus had already lost all its leaves, September 29th, the others only a few of them; of the latter, Myrica cerifera still held most of its leaves, November 30th, Quercus palustris had still a good many leaves, the others had still a few, and Baccharis had still some at Christmas.